In reply, the authors explain that as their paper is addressed mainly to general readers and field entomologists they have followed a method sanctioned by previous practice—see C.F.C. Beeson (1941) : THE ECOLOGY AND CONTROL OF THE FOREST INSECTS OF INDIA AND THE NEIGHBOURING COUNTRIES ; and M. S. Mani & Santokh Singh (1961 and 1962) : ' Entomological Survey of Himalaya ', published in volumes 58 to 60.

An errata slip is issued separately to correct errors and omissions pointed out by Mr. Sevastopulo.

BOMBAY NATURAL HISTORY SOCIETY,
BOMBAY, 1-BR, EDITORS
April 21, 1965.

14. ON THE OCCURRENCE OF THE TUBE-WORM *LOIMIA MEDUSA* (SAVIGNY) IN BOMBAY WATERS AND ITS COMMENSALISM WITH A PORCELLANID CRAB

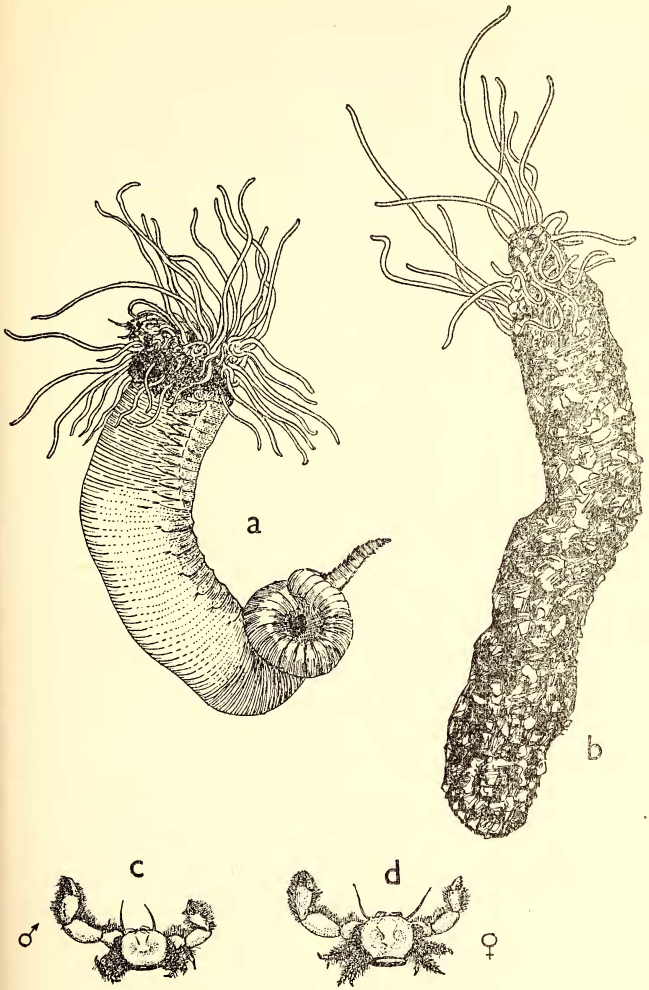
(*With one plate*)

While digging for Thalassinids mud-lobsters at Chowpatty, Bombay, on 14 Jan. 1964, a porcellanid crab (Plate, c and d) was seen emerging from the tube of a tube-worm *Loimia medusa* (Savigny) [Annelida : Terebellidae] (Plate, a and b). The crab was identified as *Polyonyx* sp. (Crustacea : Anomura). Further taxonomic determination was not possible as the crab was not represented in the collection of *Polyonyx* material with the senior author and did not agree with the description of any known species. The crab is being described separately by the senior author[1]. The present paper records behaviour studies of the two associated animals *Loimia* and *Polyonyx*, which were always found together in several collections made subsequently.

In India, *L. medusa* has been recorded on the east coast from Madras by Fauvel (1930 and 1953) and from Krusadai Island by Gravely (1927), but without any mention about its commensalism. Hence, this is the first record of the worm as a commensal and of its occurrence on the west coast of India.

From previous records, the association of *Polyonyx* with other animals seems to be a common feature. Miyake (1945) found *P. utinomi* and *P. macrocheles* both commensal with *Chaetopterus*. Johnson (1958) described *P. macrocheles*, *P. utinomi*, and *P. sinensis* in association

[1] See K. N. Sankolli : ' On a new species of commensal porcellanid crab, *Polyonyx loimicola* sp. nov. from India : (Crustacea, Anomura, Porcellanidae) ', at pp. 285-291 above.



Loimia medusa (Savigny) and *Polyonyx loimicola*

a. Worm without tube. Note the swollen condition. *b.* Broken tube with the worm inside. *c.* Commensal crab, male. *d.* Commensal crab, female (natural size)

with *Chaetopterus* sp., *P. cometes* and *P. transversum* with the bivalve *Aspergillum*, and *P. telestophilus* on the branches of an Alcyonarian, *Telesto* sp. Haig (1960) describes *P. quandrangulatus* as commensal with *Chaetopterus variopedatus*, mentioning that only the larger tubes had the crabs in them.

From India, only two species of *Polyonyx*, viz. *P. obesulus* and *P. hendersoni* have been recorded, and a third is being described (in the press, Sankolli). Of these *obesulus* is found to occur in sponges (Gravely, op. cit.) and as a crevice-dwelling form (Johnson, op. cit.); *hendersoni*, though not living in association with any other animal, occurs in colonies of corals and sponges (Johnson, op. cit.); and the new species is found to occur in sponge colonies. None of these three, however, has been reported as a true commensal. Besides *Polyonyx*, interesting observations have been made on the association of *Porcellanella* sp. with the sea pen *Pteroides esperi* by Jones (1959).

Field observations

The tubes of *L. medusa* project ½ to 2 in. above the ground and can be easily spotted during low tide in the intertidal zone. The exterior opening of the tube measures at most ¼ in. in diameter and the length of the tube varies between 8 and 12 in. Attempts to take out the entire tube with the worm in it were not successful. The tubes were found mostly on the leeward side of stones or boulders, lying either in sand or in a mixture of sand and mud, where generally Thalassinids, especially Upogebiids, abound. It was often observed that the tubes ran almost parallel to the burrows of the Upogebiids. Each tube is unbranched and is composed mainly of calcareous pieces and sand grains cemented together by a sticky substance. The tube did not wrap the worm along its attachment to the rocky substratum.

The worm is 8 to 10 in. long, brownish green in colour, with whitish tentacles, much-branched brownish red gills, and red ventral plates.

The commensal crabs are always found in a pair inside a tube. They are hairy and light-brown in colour, matching well with the tube. Most of the females were in berried condition.

Observations in captivity

The behaviour of the worm and the commensal crabs was studied independently and also in relation to each other in a series of small aquarium tanks, each measuring 12 in. × 9 in. × 9 in. For simulating the natural habitat, about 3 in. layer of coarse sand gathered from

the locality where they were collected was spread out on the bottom of the tanks.

The worms, without tubes or with parts of broken tubes, displayed vigorous rhythmic dilations and contractions of the girth of the body, the movements originating from the posterior end of the trunk and progressing to the anterior end. These movements were relatively much less vigorous in worms with almost intact tubes.

The worms, especially those deprived of their tubes, would extend their tentacles and contract them immediately on the slightest mechanical disturbance, e.g. if the tentacles or the body were touched with a finger or a glass rod. After a while, if left undisturbed, the activity would be resumed. If a tentacle came in contact with a shell piece in the sand, it would start contracting bringing the shell piece with it towards the head end, at the same time repeatedly rolling it as though something sticky was being secreted on to it. After a while the piece would be dropped near the head end. Though this behaviour continued for 8 to 12 hours, the worm failed to build a tube. It would remain contracted in length with occasional attempts to build a new tube, but there would be vigorous pulsations in girth and the main part of the body would continue swollen for hours. In the swollen state the girth was 2 to 2½ times the normal girth (slightly less than ¼ in.) inside the tube. The naked worms survived for 5-7 days but a few died even earlier than 48 hours.

With a view to increasing the survival period and assisting the worm in building a new tube, plastic and rubber tubes of suitable diameter and length were tried but without success as the worm wriggled out of the tube almost immediately after introduction.

Further observations were made with specimens provided with partly broken tubes of 1 to 3 in. length. The shell pieces rolled by the tentacles near the head end, instead of being just dropped as in the case of naked worms, were stuck on to the anterior end of the broken tube by the tentacles. These pieces could not be easily pulled out with a forceps, indicating that the shell pieces or sand particles were pasted with an adherent, which is probably secreted by the collar or oral region of the worm. The adherence of the shell particles to the tentacles suggests that the tentacles are also capable of secreting mucous-like sticky substance.

The tube material was thus added piece by piece till, in nearly two hours, about ½ in. length of new tube was added to the anterior end of the old tube. After adding the new portion in this manner, the worm gradually pushed itself inside till the whole animal was covered by the tube. The building of the tube, however, continued till it reached a length of 10-12 in. and this was achieved within 48 hours. The length of the rebuilt tubes, often ranged from 18-24 in., the tubes many a time